

I CLAIM:

- 1        1. A clip on tubing welder for making a seal across a length of heat weldable tubing,
- 2        said welder comprising in combination:
  - 3            a) a source of a gas under pressure;
  - 4            b) a source of electrical signals;
  - 5            c) an upper frame, a lower frame and pivot means for pivotally interconnecting
  - 6        said upper and lower frames;
  - 7            d) an expandable and contractible pneumatic bladder responsive to said source of
  - 8        a gas under pressure for urging pivotal movement of said upper and lower frames relative to one
  - 9        another to engage the tubing therebetween;
  - 10          e) a pair of spaced apart grippers disposed in said lower frame in operative
  - 11        engagement with a further pair of spaced apart grippers disposed in said upper frame for gripping
  - 12        the tubing to be sealed;
  - 13          f) a first jaw disposed in said lower frame intermediate said pair of grippers and a
  - 14        second jaw disposed in said upper frame intermediate said pair of further grippers and in opposed
  - 15        relationship to said first jaw for compressing tubing placed therebetween and effecting a seal
  - 16        across the tubing;
  - 17          g) an element for heating the tubing to effect a seal across the tubing and being
  - 18        disposed in at least one jaw of said first and second jaws, said element being in operative
  - 19        engagement with said source of electrical signals; and
  - 20          h) a cooling assembly for cooling at least one jaw of said first and second jaws on
  - 21        completion of the seal across the tubing in response to signals from said source of electrical

22 signals and operatively responsive to said source of gas under pressure to provide a flow of gas  
23 proximate said first and second jaws.

1           2. A clip on tubing welder as set forth in Claim 1 including a thermocouple in  
2 operative engagement with said heating element for sensing the temperature of said heating  
3 element and for providing a signal to said source of electrical signals reflective of the  
4 temperature sensed.

1           3. A clip on tubing welder as set forth in Claim 1 including a further element for  
2 heating being disposed in the other of said first and second jaws, said further heating element  
3 being in operative engagement with said source of electrical signals.

1           4. A clip on tubing welder as set forth in Claim 3 including a thermocouple in  
2 operative engagement with each of said heating element and said further heating element for  
3 sensing the temperature of said heating element and said further heating element and for  
4 providing respective signals to said source of electrical signals reflective of each of the  
5 temperatures sensed.

1           5. A clip on tubing welder as set forth in Claim 1 wherein said cooling assembly  
2 includes a passageway extending proximate said heating element and for exhausting the flow of  
3 gas to the atmosphere.

1           6.     A clip on tubing welder as set forth in Claim 3 wherein said cooling assembly  
2     includes a passageway extending proximate said heating element and a further passageway  
3     extending proximate said further heating element for exhausting the flow of gas from said  
4     passageway and said further passageway to the atmosphere.

1           7.     A clip on tubing welder as set forth in Claim 1 wherein the gas is air.

1           8.     A clip on tubing welder as set forth in Claim 1 wherein each gripper of said pair  
2     of grippers and said further pair of grippers includes a depression for receiving a part of the  
3     tubing, each of said depressions being sized less than half the cross section of the tubing to effect  
4     compression and gripping of the tubing.

1           9.     A clip on tubing welder as set forth in Claim 8 wherein each of said upper and  
2     lower frames includes opposing wall sections for limiting the degree of compression of the  
3     tubing.

1           10.    A clip on tubing welder as set forth in Claim 9 wherein said wall sections limit the  
2     proximity of said first jaw relative to said second jaw to a distance essentially no greater than  
3     twice the wall thickness of the tubing placed therebetween.

1           11.     A clip on tubing welder for making a seal across a length of heat weldable tubing,

2     said welder comprising in combination:

3               a) a first frame, a second frame and a pivot for pivotally interconnecting said first

4     and second frames;

5               b) a jaw disposed in each of said first and second frames for compressing and

6     sealing the length of tubing placed thereacross;

7               c) a first pair of tubing grippers disposed on opposed sides of said one jaw in one

8     of said first and second frames and in operative engagement with a second pair of tubing grippers

9     disposed in the other of said first and second frames for gripping the length of tubing;

10              d) a bellows for selectively actuating pivotal movement of said first and second

11     frames to cause said first and second pairs of grippers to grip the length of tubing and to

12     compress the length of tubing between said jaws; and

13              e) an element disposed in at least one of said jaws for heating the compressed

14     tubing placed thereacross.

1           12.     A clip on tubing welder as set forth in Claim 11 wherein each gripper of said first

2     pair of grippers and of said second pair of grippers includes a depression for receiving a part of

3     the tubing, each of said depressions being sized less than half the cross section of the tubing to

4     effect compression and gripping of the tubing.

1           13.     A clip on tubing welder as set forth in Claim 12 wherein each of said first and

2     second frames includes opposing wall sections for limiting the degree of compression of the

3 tubing.

1           14. A clip on tubing welder as set forth in Claim 13 wherein said wall sections limit  
2 the proximity of said first and second jaws with respect to one another to a distance essentially no  
3 more than twice the wall thickness of the tubing placed therebetween.

1           15. A clip on tubing welder as set forth in Claim 11 including a source of air pressure  
2 for actuating said bellows.

1           16. A clip on tubing welder as set forth in Claim 11 including a programmable  
2 controller for controlling operation of said source of air pressure and of the heating of said at  
3 least one jaw.

1           17. A clip on tubing welder as set forth in Claim 16 including a thermocouple  
2 associated with at least one of said heating elements for sensing the temperature of each of said  
3 jaws and for transmitting a signal indicative of the temperature sensed to said programmable  
4 controller.

1           18. A clip on tubing welder as set forth in Claim 16 including a cooling assembly for  
2 cooling each of said heating elements with a flow of air, said cooling assembly including a  
3 source of air under pressure, a passageway disposed in proximity to each of said heating elements  
4 for exhausting the flow of air to the atmosphere and a conduit interconnecting each passageway

5       of said passageways with said source of air under pressure and a valve responsive to said  
6       programmable controller for controlling the flow of air to each passageway of said passageways.

1           19.      A clip on tubing welder as set forth in Claim 18 including a heating element  
2       disposed in each of said jaws.

1           20.     A clip on tubing welder as set forth in Claim 11 including limit means for limiting  
2       movement of said jaws toward one another to a distance no greater than twice the wall thickness  
3       of the tubing.

1           21.     A method for unattended sealing of tubing with a clip on welder, said method  
2       comprising the steps of:

3               a) clipping the welder at two spaced apart locations on a length of the tubing to be  
4       sealed;

5               b) energizing at least one jaw for heating and melting the tubing to form a seal  
6       intermediate the two locations;

7               c) providing a source of gas under pressure on command to practice said step of  
8       clipping;

9               d) further providing a source of electrical signals to effectuate said step of  
10      energizing; and

11               e) unclipping the welder from the length of tubing on completion of the seal.

1           22. The method as set forth in Claim 21 wherein the at least one jaw includes a pair of  
2         opposed jaws and said step of clipping includes the step of moving the jaws toward one another  
3         to compress the tubing therebetween.

1           23. The method as set forth in Claim 22 including the step of limiting movement of  
2         the jaws to a spaced apart distance equivalent to no more than twice the wall thickness of the  
3         tubing being compressed.

1           24. The method as set forth in Claim 21 including the step of cooling the jaws on  
2         completion of the seal, said step of cooling including the step of forcing air through a passageway  
3         in at least one of the jaws and exhausting the air from the passageway to the atmosphere.

1           25. The method as set forth in Claim 21 including the step of sensing the temperature  
2         of at least one jaw and the step of controlling the heating of the tubing as a function of the  
3         temperature sensed.

1           26. The method as set forth in Claim 21 wherein the welder includes an upper and a  
2         lower frame pivotally interconnected and wherein said step of clipping and said step of  
3         unclipping includes the step of pivoting the upper and lower frames relative to one another.

1           27. The method as set forth in Claim 26 including the step of inflating and deflating a

2        bellows to exercise said steps of clipping and unclipping.

1            28.      The method as set forth in Claim 27 wherein said step of clipping includes the  
2        step of gripping the tubing at two spaced apart locations.

1            29.      The method as set forth in Claim 21 including a programmable controller for  
2        exercising each of the steps of clipping, energizing, providing, further providing and unclipping.

1            30.      The method as set forth in Claim 21 including the step of thermally insulating  
2        each of the jaws from adjacent elements.

1            31.      A method for forming a weld across a length of tubing to be sealed with a welder  
2        temporarily clipped on the length of tubing, said method comprising the steps of:

3                a) inserting a length of tubing through the welder in engagement with two pairs of  
4        grippers at spaced apart locations and bracketing a pair of jaws;

5                b) urging the two pairs of grippers and the pair of jaws toward one another to  
6        compress the tubing therebetween;

7                c) energizing at least one jaw of the pair of jaws to heat the tubing therebetween  
8        and form a seal across the tubing; and

9                d) terminating said step of energizing on formation of a weld across the tubing.

1            32.      The method as set forth in Claim 31 wherein the welder includes an upper and a

2 lower frame pivotally interconnected with one another and wherein said step of inserting includes  
3 the step of inserting the tubing between the upper and lower frames.

1           33.     The method as set forth in Claim 31 wherein said step of urging includes the step  
2 of urging pivotal movement of the upper and lower frames with an inflatable bellows.

1           34.     The method as set forth in Claim 31 including the step of providing a gas under  
2 pressure to the bellows from a source of gas under pressure.

1           35.     The method as set forth in Claim 31 wherein said steps of energizing comprises  
2 the step of energizing a heating element disposed in each jaw of the pair of jaws.

1           36.     The method as set forth in Claim 35 including the step of cooling each heating  
2 element with a flow of air.

1           37.     The method as set forth in Claim 36 including the step of providing a source of air  
2 under pressure and the step of conveying the air under pressure to each heating element.

1           38.     The method as set forth in Claim 31 including a programmable controller and  
2 including the step of controlling said urging step, said energizing step and said terminating step  
3 with the programmable controller.

1           39.     The method as set forth in Claim 38 including the step of cooling each heating  
2     element with a flow of air, said step of cooling being controlled by the programmable controller.

1           40.     The method as set forth in Claim 31 including the step of sensing the temperature  
2     of each heating element and providing a signal reflective of each sensed temperature.

1           41.     The method as set forth in Claim 38 including the step of sensing the temperature  
2     of each heating element and providing a signal to the programmable controller reflective of each  
3     sensed temperature.

1           42.     A clip on welder for making a weld in a heat weldable material, said welder  
2     comprising in combination:  
3               a) a source of a gas under pressure;  
4               b) a source of electrical signals;  
5               c) an upper frame, a lower frame and pivot means for pivotally interconnecting  
6     said upper and lower frames;  
7               d) an expandable and contractible pneumatic bladder responsive to said source of  
8     a gas under pressure for urging pivotal movement of said upper and lower frames relative to one  
9     another to engage the material therebetween;  
10              e) a pair of spaced apart grippers disposed in said lower frame in operative  
11     engagement with a further pair of spaced apart grippers disposed in said upper frame for gripping  
12     the material to be welded;

13                   f) a first jaw disposed in said lower frame intermediate said pair of grippers and a  
14       second jaw disposed in said upper frame intermediate said pair of further grippers and in opposed  
15       relationship to said first jaw for compressing the material placed therebetween and effecting a  
16       weld;

17                   g) an element for heating the material to effect a weld and being disposed in at  
18       least one jaw of said first and second jaws, said element being in operative engagement with said  
19       source of electrical signals; and

20                   h) a cooling assembly for cooling at least one jaw of said first and second jaws on  
21       completion of the weld in response to signals from said source of electrical signals and  
22       operatively responsive to said source of gas under pressure to provide a flow of gas proximate  
23       said first and second jaws.

1                  43.       A clip on welder as set forth in Claim 42 including a thermocouple in operative  
2       engagement with said heating element for sensing the temperature of said heating element and  
3       for providing a signal to said source of electrical signals reflective of the temperature sensed.

1                  44.       A clip on welder as set forth in Claim 42 including a further element for heating  
2       being disposed in the other of said first and second jaws, said further heating element being in  
3       operative engagement with said source of electrical signals.

1                  45.       A clip on welder as set forth in Claim 44 including a thermocouple in operative  
2       engagement with each of said heating element and said further heating element for sensing the

3       temperature of said heating element and said further heating element and for providing respective  
4       signals to said source of electrical signals reflective of each of the temperatures sensed.

1           46.     A clip on welder as set forth in Claim 42 wherein each of said upper and lower  
2       frames includes opposing wall sections for limiting the degree of compression of the material.

1           47.     A clip on welder for making a weld in a heat weldable material, said welder  
2       comprising in combination:  
3               a) a first frame, a second frame and a pivot for pivotally interconnecting said first  
4       and second frames;  
5               b) a jaw disposed in each of said first and second frames for compressing and  
6       sealing the material placed thereacross;  
7               c) a first pair of grippers disposed on opposed sides of said one jaw in one of said  
8       first and second frames and in operative engagement with a second pair of grippers disposed in  
9       the other of said first and second frames for gripping the material;  
10          d) a bellows for selectively actuating pivotal movement of said first and second  
11       frames to cause said first and second pairs of grippers to grip the material and to compress the  
12       material between said jaws; and  
13          e) an element disposed in at least one of said jaws for heating the compressed  
14       material placed thereacross.

1           48.     A clip on welder as set forth in Claim 47 wherein each of said first and second

2 frames includes opposing wall sections for limiting the degree of compression of the material.

1           49. A clip on welder as set forth in Claim 47 including a programmable controller for  
2 controlling operation of said source of air pressure and of the heating of said at least one jaw.

1           50. A clip on welder as set forth in Claim 49 including a thermocouple associated  
2 with at least one of said heating elements for sensing the temperature of each of said jaws and for  
3 transmitting a signal indicative of the temperature sensed to said programmable controller.

1           51. A clip on welder as set forth in Claim 49 including a cooling assembly for cooling  
2 each of said heating elements with a flow of air, said cooling assembly including a source of air  
3 under pressure, a passageway disposed in proximity to each of said heating elements for  
4 exhausting the flow of air to the atmosphere and a conduit interconnecting each passageway of  
5 said passageways with said source of air under pressure and a valve responsive to said  
6 programmable controller for controlling the flow of air to each passageway of said passageways.

1           52. A clip on welder as set forth in Claim 47 including limit means for limiting  
2 movement of said jaws toward one another to a distance which is a function of the material and  
3 the degree of compression sought.

1           53. A method for unattended welding of heat weldable material with a clip on welder,  
2 said method comprising the steps of:

- 3           a) clipping the welder at two spaced apart locations on the material to be welded;
- 4           b) energizing at least one jaw for heating and melting the material to form a weld
- 5           intermediate the two locations;
- 6           c) providing a source of gas under pressure on command to practice said step of
- 7           clipping;
- 8           d) further providing a source of electrical signals to effectuate said step of
- 9           energizing; and
- 10          e) unclipping the welder from the material on completion of the seal.

1           54.     The method as set forth in Claim 53 wherein the at least one jaw includes a pair of  
2           opposed jaws and said step of clipping includes the step of moving the jaws toward one another  
3           to compress the material therebetween.

1           55.     The method as set forth in Claim 53 including the step of cooling the jaws on  
2           completion of the seal, said step of cooling including the step of forcing air through a passageway  
3           in at least one of the jaws and exhausting the air from the passageway to the atmosphere.

1           56.     The method as set forth in Claim 53 including the step of sensing the temperature  
2           of at least one jaw and the step of controlling the heating of the material as a function of the  
3           temperature sensed.

1           57.     The method as set forth in Claim 53 wherein the welder includes an upper and a

2 lower frame pivotally interconnected and wherein said step of clipping and said step of  
3 unclipping includes the step of pivoting the upper and lower frames relative to one another.

1 58. The method as set forth in Claim 53 including the step of inflating and deflating a  
2 bellows to exercise said steps of clipping and unclipping.

1 59. The method as set forth in Claim 58 wherein said step of clipping includes the  
2 step of gripping the material at two spaced apart locations.

1 60. The method as set forth in Claim 53 including a programmable controller for  
2 exercising each of the steps of clipping, energizing, providing, further providing and unclipping.

1 61. A method for welding a heat weldable material with a welder temporarily clipped  
2 on the material, said method comprising the steps of:

3 a) inserting a part of the material to be welded into the welder in engagement with  
4 two pairs of grippers at spaced apart locations and bracketing a pair of jaws;

5 b) urging the two pairs of grippers and the pair of jaws toward one another to  
6 compress the material therebetween;

7 c) energizing at least one jaw of the pair of jaws to heat the material therebetween  
8 and form a weld; and

9 d) terminating said step of energizing on formation of the weld.

1           62.     The method as set forth in Claim 61 wherein the welder includes an upper and a  
2     lower frame pivotally interconnected with one another and wherein said step of inserting includes  
3     the step of inserting a part of the material between the upper and lower frames.

1           63.     The method as set forth in Claim 61 wherein said step of urging includes the step  
2     of urging pivotal movement of the upper and lower frames with an inflatable bellows.

1           64.     The method as set forth in Claim 61 including the step of providing a gas under  
2     pressure to the bellows from a source of gas under pressure.

1           65.     The method as set forth in Claim 61 wherein said steps of energizing comprises  
2     the step of energizing a heating element disposed in each jaw of the pair of jaws.

1           66.     The method as set forth in Claim 65 including the step of cooling each jaw of the  
2     pair of jaws with a flow of air.

1           67.     The method as set forth in Claim 66 including the step of providing a source of air  
2     under pressure and the step of conveying the air under pressure to each jaw of the pair of jaws.

1           68.     The method as set forth in Claim 61 including a programmable controller and  
2     including the step of controlling said urging step, said energizing step and said terminating step  
3     with the programmable controller.

1           69.     The method as set forth in Claim 68 including the step of cooling each jaw of the  
2       pair of jaws with a flow of air, said step of cooling being controlled by the programmable  
3       controller.

1           70.     The method as set forth in Claim 61 including the step of sensing the temperature  
2       of each jaw of the pair of jaws and providing a signal reflective of each sensed temperature.

1           71.     The method as set forth in Claim 68 including the step of sensing the temperature  
2       of each jaw of the pair of jaws and providing a signal to the programmable controller reflective  
3       of each sensed temperature.